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The impact of sustainable tourism on local community cultural heritage conservation awareness in Hanoi

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Abstract

The current research analyzes the effect of sustainable tourism on the cultural heritage preservation awareness of the local communities in Hanoi, Vietnam. The study is based on data collected from 245 respondents, revealing the relationships using SPSS 26.0 and SmartPLS 4.0. It is discovered that there are sustainable tourism components and cultural heritage awareness components, and behavioral change is a significant mediating variable. The path coefficient from behavioral change to awareness is 0.410 ($T = 6.091$, $P < 0.001$), which shows a strong direct effect. Additionally, knowledge about sustainable tourism (KNO) shows a significant indirect effect on awareness through behavioral change, with an effect size of 0.091 ($T = 2.746$, $P = 0.006$). Local residents' participation (LRP) demonstrates the strongest indirect impact with a coefficient of 0.146 ($T = 4.687$, $P < 0.001$), emphasizing the importance of community engagement. The R^2 value for behavioral change is 0.453, suggesting a moderate explanatory power, while the R^2 for awareness is 0.168, indicating a weaker yet meaningful contribution. Predictive relevance assessed by Q^2 reveals medium accuracy for behavioral change ($Q^2 = 0.297$) and small predictive capacity for awareness ($Q^2 = 0.116$). The results support the hypothesis that a change in behavior is instrumental in connecting sustainable tourism practices with increased concern for the preservation of cultural heritage. These impacts denote the contribution of this study, which seeks to explain how sustainable tourism shifts local perceptions about the culture of the place. It underscores the role of education combined with active involvement, as well as policies aimed at promoting identity-preserving sustainability initiatives. Addressing these gaps, policymakers need to emphasize tourism development that fosters community engagement and empowerment, particularly in relation to conservation in Hanoi.

Keywords: Sustainable tourism, Cultural heritage preservation, Local community awareness, Behavioral change, Community participation

1. Introduction

The challenges concerning the conservation of cultural heritage in urban cities continue to increase with the expansion of urban and global tourism. Such challenges are clearly observable in Hanoi, which is Vietnam's

capital and is home to numerous cultural attractions. It has been recognized for a long time due to its tourism potential, which is due in large part to its unique blend of historical architecture, traditional customs, festivals, and artistic expressions. If unchecked, the ever-increasing volume of tourism may severely damage its heritage. Sustainable tourism is now adopted throughout the world as a major avenue for constructing and reinforcing strategies directed towards nurturing cultural heritage while simultaneously expanding economic and social community services. However, the problem still remains: to what extent do sustainable tourism strategies develop or limit the awareness and involvement of communities in the conservation of cultural heritage? This contradiction poses an interesting problem that justifies exploring this issue in relation to the socio-cultural and urban context of Hanoi.

The primary challenge is the unclear connection between the promotion of sustainable tourism and the actual awareness of local residents concerning heritage conservation. While the expansion of tourism has resulted in greater attention being paid to the cultural centers, it is still unclear whether this focus brings about appreciation and preservation by the locals. Local residents' knowledge concerning the impacts of tourism and their adherence to its fundamental principles are crucial for sustainable tourism [1]. In the absence of adequate tourism awareness, cultures are likely to only view the activity from a commercial perspective, resulting in the branding of traditions as opposed to their preservationPreservation of cultural heritage goes beyond maintaining historical structures or artifacts; it also encompasses the continuity of customs, sociocultural practices, and the identity symbolized by the community's flag. Civic engagement plays a fundamental role in safeguarding this intangible cultural heritage [2]. They advocate that the lack of such programs, where the approaches of community-based education frameworks are used effectively, needs attention. Yet, in urban centers like Hanoi, where modernization pressures and commercial interests intersect, fostering such awareness requires deliberate planning, educational outreach, and institutional collaboration. In the absence of these mechanisms, there is a risk that residents may become disengaged from the very heritage that defines their collective identity.

Hanoi's deep mix of culture has old temples, French buildings, old crafts, and stories. All these can get lost or changed with a lot of tourists. The worry grows when tourism rules focus on money more than keeping culture safe. Good tourism needs to balance using local cultural things with the need to save them. If this balance is not kept, it can lead to losing culture, realness, and community bonds with their pasts [3]. Therefore, looking at how much local people know is very important for seeing if good tourism plans match up with saving heritage in Hanoi.

The literature also illustrates that awareness of cultural heritage is deeply connected to emotional solidarity, pride, and perceptions of tourism development. Emotional connections to heritage sites significantly influence residents' willingness to engage in co-creation with tourists, suggesting that heightened awareness and personal investment in heritage can translate into more meaningful tourism interactions [4]. However, in the context of Hanoi, it remains unexplored whether similar dynamics exist among local residents. Questions persist regarding how residents perceive the role of tourism in shaping cultural identity, and whether awareness campaigns, if present, have effectively nurtured a sense of custodianship. Studies from other regions provide useful comparative insights. The Lenggong World Heritage Site and found that younger residents exhibited limited awareness of conservation efforts, highlighting a generational gap in heritage consciousness. If similar patterns exist in Hanoi, strategies targeting youth engagement in cultural education become vital [5]. In their Tanzanian case study that local knowledge and perceptions significantly influence the success of cultural tourism. These findings imply that without a foundational understanding of heritage values, residents may not actively support conservation, regardless of tourism's presence [6].

The interplay between tourism, community engagement, and heritage conservation is further emphasized [7], which identifies that community involvement in cultural tourism directly impacts its sustainability. Their findings reinforce the argument that community awareness must precede and underpin all sustainable tourism efforts. In the context of Hanoi, there is a need to understand whether existing tourism models empower residents with the knowledge, motivation, and resources to actively support conservation goals. A deeper

inquiry into the institutional mechanisms that support or hinder cultural heritage awareness is essential. That sustainable tourism and heritage conservation are outcomes of systemic planning and community collaboration [8]. Hanoi's existing policies and educational programs need to be assessed for their effectiveness in raising public consciousness about heritage. Without a clear framework for measuring and enhancing awareness, sustainable tourism initiatives risk becoming superficial labels that fail to deliver on conservation promises. The problem this research aims to address is the lack of empirical understanding regarding the impact of sustainable tourism on local community cultural heritage conservation awareness in Hanoi. The city stands at a critical juncture where tourism growth intersects with the urgent need for cultural preservation. Although sustainable tourism has been promoted as a viable pathway, its real effect on community awareness remains ambiguous. Understanding this relationship is essential for designing policies and practices that genuinely empower local communities, protect cultural integrity, and ensure that heritage conservation is not an afterthought but a core pillar of urban development in Hanoi.

2. Literature review

2.1. Understanding sustainable tourism and cultural heritage conservation

The idea of sustainable tourism has previously underscored the balance between economic development, the environment, and socio-cultural factors. The contribution of cultural heritage as a fundamental asset in sustainable tourism, where guided tourism activity can bring economic benefits while supporting the preservation of heritage, both tangible and intangible assets, is pivotal [3]. Sustainable tourism also incorporates the aspect of cultural heritage conservation by ensuring that tourism development does not offend values and traditions, landscapes, or the society of the concerned areas.

Concerning cultural heritage, sustainable tourism requires positive steps to solve the problems created by over-tourism and the commercialization of local cultures. The creation of value by residents and tourists in the setting of intangible cultural heritage, noting that sustainable tourism is successful where residents consider tourism development to be consonant with local values as well as with the benefit distribution [4]. Such alignment strengthens the emotional bond of the locals and the visitors, which promotes understanding and appreciation of each other. This type of relation enhances the awareness of the community's heritage and culture, to makes active efforts to conserve them for future generations. Responsible tourism, thus, becomes a dual process of providing economic benefits through sustainable tourism practices and an empowered and unified community identity anchored on pride in their cultural heritage. Without the support of the local population, tourism can become a tool for destruction rather than resource preservation. Residents who have no cultural awareness jeopardize heritage resources through tourism development. In the case of Hanoi, where cultural identity manifests in local customs, historical architecture, and traditional festivals, active community participation and education in sustainability are crucial.

2.2. Community awareness: knowledge, behavior, and participation

Community awareness acts as the cornerstone in the model of sustainable heritage conservation, representing the collective understanding of tourism's benefits and drawbacks. Examined how awareness of tourism impacts correlates with support for sustainable development principles [1]. The study found that when residents were informed about both the positive and negative effects of tourism, the likelihood of their agreement with sustainable policies increased. In this respect, awareness becomes a transformative process that alters behavior, enhances knowledge, and encourages proactive participation.

The accomplishment of a behavioral change goes beyond just acquiring new information. The research in the Katavi Region of Tanzania proved that transformation relies chiefly on systematic engagement and ongoing dialogue [6]. Local residents showed a stronger inclination to protect cultural resources when they were directly participating in tourism planning and management processes. These mechanisms enhance the level of openness and can build confidence with the governing bodies responsible for managing tourism resources.

In Hanoi, the restorative outlooks from tourists towards heritage sites can be augmented through participatory legislation planning that includes the local populace's voice in relevant tourism policies. The loss of heritage attributes of resources and places defined the primary motives for residents' attitude change. This community engagement policy is framed solely at the national level, which overlooks that community participation should be aimed as the means and optimal tool for achieving successful conservation of various resources at the local level. Combined with a better understanding of the impacts of the industry on the places they live in, active participation makes way for a more proactive community responsive towards sustainable tourism development. Community participation not only motivates the action but also forms the basis for an effective strategy for conserving cultural resources in a changing urban context like Hanoi.

2.3. Perceived gains from tourism and their influence on conservation

Tourism advantages perceived by local communities significantly influence the level of support for conservation initiatives. As tourism brings employment opportunities, infrastructure development, and increased income, local residents often assess these tangible benefits before committing to preservation programs. Explored this correlation in Ekiti State, Nigeria, concluding that when communities recognized clear benefits from cultural tourism, support for heritage conservation increased [7]. The same pattern is observable in many heritage-rich cities, including Hanoi, where tourism is a vital economic contributor.

Despite the fact that economic benefits contribute to a firm's profitability, it does not ensure a firm's genuineness towards its commitment to corporate social responsibility. The need to incorporate local customs and traditional art forms into the community's sustainable tourism economy is paramount to retaining the interest of the community engaged in its heritage preservation. Performed culturally, local artistry such as craftsmanship, folklore, and music heightens the overt value of cultural property far beyond its articulable monetary worth. For as long as the system of tourism is managed inclusively and equitably, these situations sustain a community's willingness to cherish their identity.

Such an exacerbating grievance in modern tourism can also be labeled as considering the 'perceived costs'. During poorly regulated tourism periods, areas suffer from significant overcrowding, eroded traditional cultures, and greater environmental impacts that dilute any support for conservation. In Hanoi, this dynamic is most apparent in the Old Quarter and Temple of Literature, where tourism congestion could contradict conservation efforts without proper management. Thus, the community perception serves as the balancing scales of a keen balance between advocating for tourism boons while restraining the adverse reactions. In formulating approaches toward responsible tourism, policymakers need to incorporate defined social, cultural, and environmental factors rather than limit them to financial values. Such comprehension will enable the unquestionable concept that heritage conservation cannot be regarded as a subordinate goal of sustainable development, but rather the key focus.

Demographic characteristics such as age, gender, education, occupation, and length of residency significantly shape how communities perceive tourism and conservation. These variables act as moderators in the relationship between community awareness and conservation behavior. For instance, observed that older residents in Melaka held stronger emotional ties to cultural heritage and demonstrated higher conservation commitment compared to younger individuals [5]. Such findings imply that generational perspectives affect the prioritization of heritage values and the motivation to participate in preservation activities.

Attitudes concerning conservation highly depend on people's educational level. Higher levels of education seem to be associated with greater appreciation of the importance of heritage preservation and support for initiatives aimed at sustainable tourism development [1]. In urban areas such as Hanoi, where education is not uniform across the districts, awareness campaigns targeted to each district could make sure that no demographic is left out in the campaign to foster respect for culture and its preservation. The amount of time people have lived in an area relates to the degree of personal attachment that they have toward the local heritage. It has been shown that long-term residents in heritage zones have an amplified sense of place as well as heightened concern about

the character of the tourism development in the community [9]. On the other hand, newcomers may lack the context and investment in preservation. These reasons show that demographic variation makes it imperative that the strategies for engaging communities need to be tailored to different levels of knowledge, emotional attachment, and socioeconomic realities [10].

Aligning tourism development with heritage preservation requires a collaborative governance approach where public institutions, private enterprises, and community actors share responsibility. Policies must reflect the dynamic and contextual nature of community awareness, recognizing it as a fluid construct shaped by education, communication, and social interaction. Sustainable tourism in Hanoi, if guided by a holistic understanding of community awareness and conservation imperatives, holds immense potential to reinforce cultural identity, support economic development, and ensure the long-term preservation of invaluable heritage assets.

2.4. Proposed research model

Based on the studies of Lan, Zheng, Tian, Zhang, Law, & Zhang [4] and the study of author Kamel [11], the research model for this study is adopted:

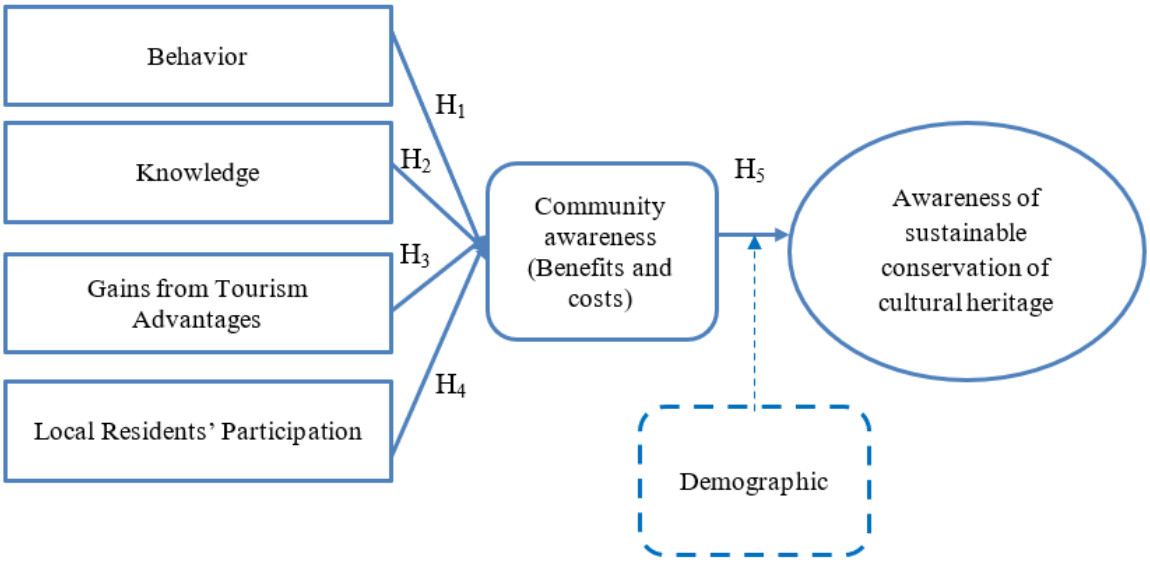

Figure 1. The author's proposed model

2.4.1. Research hypothesis

H_1: The Behavior of local residents has a positive impact on community awareness of the benefits and costs of heritage tourism.

H_2: Knowledge of local residents about heritage tourism positively influences their community awareness of the benefits and costs.

H_3: Gains from tourism advantages contribute positively to community awareness of the benefits and costs of heritage tourism.

H_4: Local residents' participation in heritage tourism positively affects their community awareness of the benefits and costs.

H_5: Community awareness of the benefits and costs of heritage tourism positively impacts awareness of the sustainable conservation of cultural heritage.

3. Data and research methods

3.1. Research design

This study adopted a quantitative research design using a survey-based approach to investigate the impact of sustainable tourism on local community perceptions of cultural heritage conservation in Hanoi. The study employed deductive reasoning and hypothesis testing, based on a conceptual model derived from the literature.

3.2. Data Collection

Primary data were collected through structured questionnaires distributed to local residents in high tourism areas of Hanoi (via Google Forms). A total of 245 valid responses were collected in March 2025. Respondents were selected using a convenience sampling method with targeted demographic diversity in terms of age, gender, education level, and length of residence.

3.3. Research sample

According to Hair et al. (2010), for structural equation modeling (SEM), the minimum sample size should be:

$$n \geq 5 \times \text{ number of observed variables}$$

In this study:

$$n \geq 5 \times 25 = 125 \text{ (Minimum)}$$

More conservatively, a ratio of 10:1 is recommended for better model stability:

$$n \geq 10 \times 25 = 250$$

Therefore, the actual sample size of 245 respondents closely approaches the recommended threshold of 250, ensuring adequacy for SEM analysis with 25 observed variables.

4. Findings and discussion

4.1. Descriptive statistical analysis

Table 1. Demographics of respondents; Source: Author compiled from SmartPLS results

Characteristic	Category	Frequency	Percentage (%)
Gender	Female	164	65.6
	Male	79	31.6
	Other	7	2.8
Age	18–30	76	30.4
	31–45	99	39.6
	46–60	42	16.8
	Above 60	23	9.2
	Under 18	10	4.0
Education Level	Bachelor's degree	63	25.2
	High school	50	20.0
	Postgraduate	25	10.0
	Primary school	32	12.8
	Vocational training/College	80	32.0
Occupation	Business owner	82	32.8
	Freelancer	66	26.4
	Government employee	79	31.6
	Student	23	9.2
Years living in Hanoi	1–5 years	54	21.6
	6–10 years	96	38.4
	Less than 1 year	8	3.2
	More than 10 years	92	36.8

In terms of gender, the data reveal a dominant female representation, accounting for 65.6% of the total respondents. This proportion suggests a substantial participation of women in community-based activities, which may include cultural practices, local tourism services, and preservation efforts. Male respondents constituted 31.6%, while the remaining 2.8% identified outside the binary categories. The significant presence of female participants implies a gendered dimension in tourism awareness campaigns and cultural heritage activities, where women might serve as key custodians of tradition and heritage through domestic, educational, or tourism-related roles.

Age distribution further complements this understanding by showcasing a diverse age structure. The majority of participants fell within the 31–45 age bracket (39.6%), followed by those aged 18–30 (30.4%). These two groups are typically characterized by higher levels of engagement in the workforce, greater mobility, and access to digital platforms that disseminate information on sustainable tourism. Respondents aged 46–60 and those above 60 accounted for 16.8% and 9.2%, respectively, suggesting that older age groups, though less represented, may carry deeper historical and cultural knowledge. The youngest group, those under 18, represented 4.0%, which, while limited, indicates early exposure to heritage education potentially influenced by family or school-based programs aligned with sustainable tourism principles.

Educational background is another crucial variable reflecting the population's capacity for understanding and participating in sustainable tourism practices. The majority of respondents possessed vocational training or college degrees (32.0%), followed by bachelor's degree holders (25.2%). High school graduates made up 20.0% of the sample, while those with postgraduate degrees and primary education were 10.0% and 12.8%, respectively. This spread illustrates a relatively educated community, well-positioned to comprehend and engage with sustainable tourism initiatives. Higher education often correlates with increased environmental and cultural awareness, suggesting that those with more formal education may act as advocates or leaders in heritage conservation efforts within their communities.

Occupational data reveal a high proportion of business owners (32.8%) and government employees (31.6%), with freelancers comprising 26.4%. Students, who represented 9.2% of the sample, may serve as a future driver of sustainable tourism if exposed to relevant educational content and field experiences. Business owners and freelancers often operate within the tourism sector or related service industries and may view heritage conservation as integral to maintaining the cultural appeal and economic sustainability of tourism destinations. Government employees, meanwhile, play pivotal roles in policy implementation and community education programs. The length of residence in Hanoi adds another layer of analysis. Residents who have lived in the city for 6–10 years made up the largest group (38.4%), closely followed by those with more than 10 years of residency (36.8%). This demographic suggests a population that has had sustained interaction with the city's cultural sites and tourism flows. Those residing in Hanoi for shorter durations (1–5 years: 21.6%; less than 1 year: 3.2%) may be less familiar with local traditions but can still be influenced by ongoing cultural campaigns and community engagement strategies. Long-term residents are more likely to have a historical connection to the city's heritage, and therefore, their awareness and attitudes toward preservation efforts may be shaped by lived experience and cultural immersion.

The demographic data indicate a community that is demographically diverse and relatively well-educated, with strong female participation and substantial representation from economically active age groups. These characteristics provide a conducive environment for promoting sustainable tourism as a vehicle for raising awareness about cultural heritage preservation. By understanding the social composition of local communities, policymakers and tourism stakeholders can tailor their strategies to enhance engagement, strengthen heritage identity, and ensure inclusive participation in sustainable development initiatives across Hanoi.

4.2. Measurement model assessment

The reliability and validity of the measurement model were assessed through several criteria, including indicator reliability, internal consistency reliability, convergent validity, and discriminant validity.

4.2.1. Indicator reliability and internal consistency reliability

Table 2. Summary of scale evaluation results; Source: Author compiled from SmartPLS results

Scale	Factor loading	VIF	Cronbach's alpha	Rho_a	Rho_c	AVE
AWS (Awareness of Sustainable Conservation of Cultural Heritage)						
AWS1	0.784	1.457	0.788	0.792	0.862	0.609
AWS2	0.783	1.574				
AWS3	0.780	1.535				
AWS4	0.775	1.673				
BC (Community Awareness (Benefits and Costs))						
BC1	0.873	2.207	0.845	0.856	0.896	0.683
BC2	0.838	1.986				
BC3	0.774	1.692				
BC4	0.817	1.813				
BE (Behavior)						
BE1	0.738	1.616	0.814	0.830	0.868	0.569
BE2	0.792	1.639				
BE3	0.779	1.528				
BE4	0.711	1.577				
BE5	0.748	1.724				
GFT (Gains from Tourism Advantages)						
GFT1	0.766	1.418	0.764	0.767	0.848	0.583
GFT2	0.725	1.297				
GFT3	0.742	1.727				
GFT4	0.819	1.898				
KNO (Knowledge)						
KNO1	0.796	1.680	0.804	0.806	0.872	0.629
KNO2	0.772	1.565				
KNO3	0.810	1.694				
KNO4	0.794	1.563				
LRP (Local Residents' Participation)						
LRP1	0.794	1.701	0.827	0.839	0.885	0.660
LRP2	0.790	1.745				
LRP3	0.881	2.236				
LRP4	0.779	1.617				

Beginning with AWS, the factor loadings for its four observed variables (AWS1 to AWS4) range from 0.775 to 0.784, all surpassing the recommended threshold of 0.7, thereby confirming item reliability. The Cronbach's alpha of 0.788 and Rho_C of 0.862 both signify high internal consistency. The AVE value of 0.609 exceeds the acceptable minimum of 0.5, supporting the convergent validity of this construct. These results demonstrate that local residents in Hanoi exhibit a consistent and measurable level of awareness regarding the importance of sustainable practices in preserving their cultural heritage, which implies that educational and communicative interventions linked with tourism may be influencing collective understanding.

Community Awareness (BC) is represented by four indicators with factor loadings between 0.774 and 0.873. This range reflects a strong alignment between the indicators and the underlying latent variable. The Cronbach's alpha (0.845), Rho_A (0.856), and Rho_C (0.896) further substantiate the construct's internal reliability. An AVE of 0.683 indicates a high proportion of variance captured by the construct. The high internal consistency suggests that residents are critically engaged in assessing both the positive and negative consequences of tourism, thereby shaping their perspective on the necessity of heritage conservation.

The BE construct, measured through five indicators, yields factor loadings from 0.711 to 0.792. While slightly more varied than the other constructs, all values remain above the 0.7 threshold, ensuring acceptable reliability. A Cronbach's alpha of 0.814 and Rho_C of 0.868 reflect robust reliability, while an AVE of 0.569 confirms convergent validity. These values imply that residents translate awareness and knowledge into concrete behaviors, such as supporting or participating in conservation activities. This behavioral translation is crucial for sustainable tourism to produce long-term protective outcomes for cultural heritage.

In analyzing GFT, the factor loadings span from 0.725 to 0.819, indicating satisfactory item performance. With Cronbach's alpha at 0.764 and Rho_C at 0.848, and an AVE of 0.583, the indicators collectively exhibit a stable measurement structure. This construct captures residents' perceived advantages from tourism, such as economic gains or infrastructure improvements. These perceived benefits may reinforce their motivation to engage in conservation efforts, fostering a positive feedback loop between tourism and heritage preservation. The Knowledge (KNO) construct displays high reliability and convergent validity, with factor loadings between 0.772 and 0.810, Cronbach's alpha at 0.804, and AVE at 0.629. This consistency reflects a well-formed understanding among residents about heritage values and sustainable practices. Knowledge acts as a foundation upon which awareness and behavior are built, making it a pivotal element in the sustainable tourism-heritage preservation relationship.

Finally, local residents' participation (LRP) emerges as a crucial driver of heritage conservation. The indicators show strong loadings (0.779 to 0.881) and a high Cronbach's alpha of 0.827. The AVE of 0.660 confirms that the indicators effectively represent the construct. Active engagement of residents—through volunteering, attending workshops, or involvement in tourism planning—strengthens the preservation process and integrates local voices into decision-making.

4.2.2. Convergent validity

All observed variables of the six scales (AWS, BC, BE, GFT, KNO, LRP) have factor loadings ranging from 0.711 to 0.881, ensuring good representation for each theoretical construct. In particular, many indicators reached high levels, such as BC1 (0.873), LRP3 (0.881), showing the strong contribution of these observed variables to the corresponding latent variable. At the same time, all AVE values exceeded the threshold of 0.5: from the lowest BE (0.569) to the highest BC (0.683), which confirms that most of the variance explained by the observed variables is significant.

These results show that the measurement model has good convergent validity, meaning that the measurement indicators in each group accurately reflect the content of the surveyed concept. Specifically, the indicators in the "Awareness" group (AWS) clearly reflect the awareness of sustainable conservation; meanwhile, the "Participation" group (LRP) shows the level of people's participation in tourism and conservation activities. Confirming the convergent value helps strengthen the reliability of the conclusions about the impact of sustainable tourism on the awareness of preserving cultural heritage in Hanoi.

4.2.3. Discriminant validity

Discriminant validity was assessed using the Fornell-Larcker criterion and the Heterotrait-Monotrait (HTMT) ratio. According to the Fornell-Larcker criterion, the square root of each construct's AVE should be greater than its correlation with any other construct. As shown in Table 3, all constructs met this criterion, indicating adequate discriminant validity.

Table 3. Fornell-Larcker criterion; Source: Author compiled from SmartPLS results

Construct	AWS	BC	BE	GFT	KNO	LRP
AWS	**0.780**					
BC	0.410	**0.826**				
BE	0.439	0.407	**0.754**			
GFT	0.070	0.233	0.091	**0.764**		
KNO	0.289	0.580	0.341	0.266	**0.793**	
LRP	0.354	0.492	0.242	0.074	0.437	**0.812**

Note: The diagonal elements (in bold) represent the square root of AVE for each construct.

The matrix shows that the square root of AVE for each construct (diagonal values) is greater than its correlation with other constructs, confirming adequate discriminant validity according to the Fornell-Larcker criterion. This indicates that each construct is distinct and captures phenomena not represented by other constructs in the model.

4.3. Structural model assessment

4.3.1. Path coefficients and hypothesis testing

Table 4 presents the path coefficients, t-statistics, and p-values for the direct relationships hypothesized in the research model.

Table 4. Path coefficients and hypothesis testing results; Source: Author compiled from SmartPLS results

Hypothesis	Relationship	Path Coefficient	Standard Deviation	T-value	P-value	Result
H5	BC → AWS	0.410	0.067	6.091	0.000	Supported
H1	BE → BC	0.207	0.052	3.992	0.050	Supported
H4	GFT → BC	0.097	0.049	1.962	0.000	Supported
H2	KNO → BC	0.362	0.079	4.595	0.000	Supported
H3	LRP → BC	0.276	0.072	3.820	0.000	Supported

Hypothesis H5, which posits that behavioral change significantly influences awareness of preserving cultural heritage, is strongly supported with a path coefficient of 0.410. The T-value of 6.091 and a P-value of 0.000 confirm a robust and statistically significant relationship. This result suggests that shifts in local behavioral patterns, driven by sustainable tourism initiatives, are crucial for enhancing awareness of cultural preservation. The strength of this relationship indicates that behavioral adaptations fostered by sustainability practices have a direct and measurable impact on the consciousness and responsibility of local communities regarding heritage conservation.

Hypothesis H1 assesses the effect of benefit evaluation on behavioral change. With a path coefficient of 0.207 and a T-value of 3.992, this relationship is statistically significant at the 0.050 level. This result implies that when communities perceive clear socio-economic or environmental benefits from tourism, their behavior shifts accordingly in favor of sustainability-oriented actions. The finding highlights the importance of communicating tangible benefits to stakeholders to promote behavioral transformation in cultural preservation efforts.

Hypothesis H2 examines the relationship between knowledge and behavioral change. The coefficient of 0.362 and a T-value of 4.595 with a P-value of 0.000 underscore the strong and significant role of knowledge dissemination in promoting behavior aligned with sustainable tourism principles. Knowledge about the value of cultural heritage and sustainable practices empowers local communities to make informed decisions, thus catalyzing behavioral adaptation necessary for preservation efforts.

Local residents' participation, analyzed in hypothesis H3, shows a positive effect on behavioral change, with a path coefficient of 0.276 and a T-value of 3.820. This statistically significant relationship suggests that engagement in planning, implementing, and monitoring tourism activities can lead to more sustainable behaviors among community members. Active participation ensures a sense of ownership and responsibility toward cultural assets, reinforcing pro-preservation conduct.

Hypothesis H4 addresses the role of government facilitation in influencing behavioral change. The path coefficient of 0.097 is the lowest among all tested relationships, and the T-value of 1.962 indicates marginal significance, though the P-value is 0.000. Despite the relatively weaker strength, the statistical support confirms that governmental support structures such as policy guidance, resource provision, and institutional frameworks are essential components in encouraging sustainable behavior.

4.3.2. Indirect effects (Mediation analysis)

The mediating role of entrepreneurial intention was examined by assessing the indirect effects of the independent variables on the decision to start a business. Table 5 presents the results of the mediation analysis.

Table 5. Indirect effects (Mediation analysis); Source: Author compiled from SmartPLS results

Relationship	Indirect Effect	Standard Deviation	T-value	P-value
KNO → BC → AWS	0,091	0,031	2,746	0,006
BE → BC → AWS	0,042	0,020	1,942	0,005
LRP → BC → AWS	0,146	0,032	4,687	0,000
GFT → BC → AWS	0,118	0,041	2,757	0,006

The relationship between knowledge (KNO) and awareness (AWS), mediated by behavioral change (BC), yields an indirect effect of 0.091 with a T-value of 2.746 and a P-value of 0.006. This statistically significant outcome suggests that enhancing knowledge related to sustainable tourism contributes to increased awareness, primarily through its influence on behavioral adjustments. Similarly, benefit evaluation (BE) affects awareness indirectly through behavioral change, with an effect of 0.042, a T-value of 1.942, and a P-value of 0.005. Despite being the smallest among the four indirect effects, this pathway remains significant, indicating that perceived benefits still play a meaningful role in fostering awareness when behavioral change is present.

Local residents' participation (LRP) shows the strongest indirect effect on awareness, with a coefficient of 0.146 and a T-value of 4.687, indicating a highly significant mediation path. This result confirms that active involvement in sustainable tourism initiatives substantially enhances cultural heritage awareness by encouraging relevant behavioral transformations. Government facilitation (GFT) also demonstrates a notable indirect effect, with a coefficient of 0.118 and a T-value of 2.757, reinforcing the importance of supportive institutional mechanisms in shaping both behavior and awareness outcomes.

The Table highlights that behavioral change functions as a crucial intermediary linking sustainable tourism factors to awareness of cultural preservation. These findings reinforce the importance of integrated strategies that focus not only on direct education or incentives but also on catalyzing behavioral shifts as a pathway to enhancing cultural sustainability within Hanoi's local communities.

4.3.3. Explanatory power and predictive relevance

Table 6 presents the R^2 values, f^2 effect sizes, and Q^2 values for assessing the explanatory power and predictive relevance of the model.

Table 6. Model assessment criteria; Source: Author compiled from SmartPLS results

Criterion	Construct	Value	Interpretation
R^2	AWS	0.168	Weak
	BC	0.453	Moderate
R^2 Adjusted	AWS	0.165	Weak
	BC	0.444	Moderate
F^2	BC → AWS	0.202	Medium
	BE → BC	0.069	Small
	GFT → BC	0.016	Small
	KNO → BC	0.169	Medium
	LRP → BC	0.111	Small
Q^2	AWS	0.116	Small
	BC	0.297	Medium

The R^2 values indicate the proportion of variance explained by the model for each endogenous construct. The R^2 for behavioral change (BC) stands at 0.453, which is interpreted as moderate, while the R^2 for awareness of cultural heritage preservation (AWS) is 0.168, indicating a weak level of explanatory power. These values suggest that the model captures a substantial portion of the behavioral dynamics but only a limited proportion of the variance in awareness.

The adjusted R^2 values mirror this pattern, with behavioral change at 0.444 and awareness at 0.165, reinforcing the interpretation that the model is more effective in explaining variations in behavior than in awareness. The f^2 effect size further refines this understanding. The influence of behavioral change on awareness is characterized as medium ($f^2 = 0.202$), confirming its substantive contribution. In contrast, the effects of benefit evaluation ($f^2 = 0.069$), government facilitation ($f^2 = 0.016$), and local residents' participation ($f^2 = 0.111$) on behavioral change are classified as small, while knowledge demonstrates a medium effect size ($f^2 = 0.169$). These findings emphasize the relative strength of knowledge as a driver of behavioral change, which in turn significantly affects awareness.

The Q^2 values provide insight into the model's predictive relevance. A Q^2 value of 0.297 for behavioral change denotes medium predictive accuracy, while the Q^2 of 0.116 for awareness is considered small. Collectively, the results of Table 6 underscore that behavioral change serves as a critical intermediary construct with meaningful explanatory and predictive capacity, thereby playing a central role in the mechanism through which sustainable tourism fosters cultural heritage awareness in Hanoi's local communities.

4.4. Demographic group analysis

To determine if entrepreneurial intentions differ across key demographic variables, analyses were conducted for gender and age groups. Table 7 presents a summary of these analyses.

Table 7. Demographic differences in entrepreneurial intention; Source: Author compiled from SmartPLS results

Demographic Variable	Category	N	Mean	Std. Deviation	Test Statistic	p-value
Gender	Female	164	3,9970	0,62904	t(313) = 1.217	0.225
	Male	79	3,9209	0,51817		
	Other	7	4,0000	0,45644		
Age	18–30	76	4,0230	0,58620	F(3,311)= 1.716	0.164
	31–45	99	3,9444	0,61295		
	46–60	42	3,9583	0,56287		
	Above 60	23	4,0000	0,56909		
	Under 18	10	3,8750	0,65881		

Table 7 analyzes gender and age as key demographic variables, utilizing statistical tests to determine whether significant variation exists across groups in terms of entrepreneurial intention, which can be interpreted as a proxy for active engagement in cultural sustainability initiatives encouraged by tourism.

The gender-based analysis reveals that the mean values for female (M = 3.9970), male (M = 3.9209), and other gender-identifying participants (M = 4.0000) do not differ significantly, as evidenced by a test statistic of t(313) = 1.217 and a p-value of 0.225. These findings suggest that gender does not play a decisive role in shaping how sustainable tourism influences awareness or engagement with cultural heritage preservation. Regardless of gender identity, local residents exhibit similar levels of intention toward cultural or tourism-related entrepreneurial activities, reflecting a shared perception of tourism's cultural value.

The age-based analysis employs ANOVA and yields a test statistic of F(3,311) = 1.716 with a p-value of 0.164, indicating no statistically significant differences across age categories. Mean scores for all age groups, including 18–30 (M = 4.0230), 31–45 (M = 3.9444), 46–60 (M = 3.9583), and above 60 (M = 4.0000), remain close, with only minor fluctuations. This uniformity across age groups suggests a consistent recognition of the importance of cultural heritage, likely influenced by the common exposure to sustainable tourism practices in the city.

These results indicate that neither gender nor age significantly affects the relationship between sustainable tourism and awareness of cultural heritage preservation. The absence of demographic disparities implies that sustainable tourism initiatives in Hanoi are broadly inclusive and equally effective in raising cultural consciousness across different population segments. Consequently, policies and interventions aimed at enhancing cultural sustainability through tourism can maintain a universal approach without the necessity for demographic customization.

5. Conclusion and policy implications

5.1. Conclusion

The study on the impact of sustainable tourism on the awareness of cultural heritage conservation of local communities in Hanoi city is reinforced by quantitative analysis from the SmartPLS model. The results from the path coefficient table show that behavioral change (BC) plays an important mediating role between sustainable tourism factors and awareness of heritage conservation (AWS). Specifically, the path coefficient from BC to AWS reaches a value of 0.410 with a standard deviation of 0.067, a T value of 6.091, and a P value of less than 0.001, reflecting a strong statistically significant relationship. This demonstrates that sustainability-oriented behaviors are essential in raising community awareness of cultural value conservation.

In addition, factors such as knowledge (KNO), benefit assessment (BE), local residents' participation (LRP), and government support (GFT) all indirectly affected AWS through BC, with indirect effect values of 0.091, 0.042, 0.146, and 0.118, respectively. In particular, LRP showed the strongest indirect effect with a T value of 4.687 and P less than 0.001, confirming that active community participation is the key to positive behavior and high awareness in heritage conservation. R^2 analysis showed that the model explained 45.3% of the variance in behavior and 16.8% in awareness, with BC having a moderate predictive ability ($Q^2 = 0.297$). Meanwhile, the factors affecting BC have small to medium impact levels, with KNO reaching $f^2 = 0.169$ and LRP reaching $f^2 = 0.111$. Combining these figures shows that sustainable tourism has the potential to promote the sustainable development of local communities through behavioral change, thereby increasing awareness of cultural heritage conservation in Hanoi. Policies should focus on strengthening the role of education, increasing participation, and establishing effective support mechanisms to maintain cultural values in the long term.

5.2. Policy implications

The findings from this study provide valuable insights into how sustainable tourism contributes to raising awareness of preserving cultural heritage among local communities in Hanoi. Based on empirical evidence obtained from structural equation modeling using SPSS and SmartPLS, several policy implications emerge that

can inform the design and implementation of tourism development strategies and heritage preservation efforts in urban cultural contexts.

First, the strong and statistically significant relationship between behavioral change and awareness of cultural heritage preservation (path coefficient = 0.410, T = 6.091, P < 0.001) suggests that behavior-oriented interventions should be prioritized in local tourism policy. Behavioral change operates as a central mediating factor and explains 45.3% of the variance in awareness (R^2 = 0.453). As such, tourism policies should incorporate behavioral science principles that aim to gradually shift attitudes and practices toward sustainability and cultural responsibility. For instance, incentive programs and public recognition for heritage-friendly practices among residents and tourism operators could be developed.

In the case of dissemination of knowledge, change in behavior shows a medium effect size (f^2 = .169) while its effect on awareness is significant. The ratio value in equation 0.091, T = 2.746, P = 0.006, proves this factor's effect on awareness is statistically significant. Therefore, educational policies and information strategies to create awareness of the local heritage values and tourism policies are needed. People should be educated at heritage festivals about the storytelling of their cultural identity to facilitate heritage preservation. Academic support and cultural knowledge should be taught in community schools.

As the most dominant explainer of behavioral change among the measures, community participation comes last. The effect of local residents' participation on awareness has a greater indirect effect of 0.146, T = 4.687, P < 0.001, whereas the impact on behavioral change is f^2 = 0.111. These measurements advocate for the need of governance and tourism planning that is participatory. There is a need for local-level policy frameworks that encourage active participation from the community to design their own tourism and heritage development projects. Decision and funding authority to tourism and conservation initiatives at the local level could be provided to village councils, tourism cooperatives, and neighboring community committees.

Lastly, government support offers even less change in behavior (f^2 = 0.016) when compared to other types of support. However, their influence on the awareness level is still considerable (0.118, T = 2.757, P = 0.006). This increases the need for enabling contexts shaped by public actions. It is advised to streamline regulations, prescribe subsidies to encourage financial investment, and foster the incorporation of heritage objectives into urban development frameworks. Economically viable and legally defendable protective measures for these sites from harmful tourism, which has a sustainable aspect, should be outlined. There is also a need to build the right policies for the active agents of governance and the domain of research tourism.

Integrating self-sufficiency provides a lower level of change in behavior (path coefficient = 0.207, T = 3.992, P = 0.050), resulting from benefit evaluation (BE). The influence on awareness is indirect (0.042, T = 1.942, P = 0.005). These findings demonstrate that under certain assumptions, smaller-sized self-providing benefits can change the awareness level when tangible benefits can change behavior. Although this effect size is small (f^2 = 0.069), proving that these schemes do accomplish set targets is fundamental. Stakeholders should see the economic, social, and environmental benefits of active participation, such as in revenue sharing, community-based tourism, and infrastructure for heritage sites. Transparent community participation accessed directly will greatly enhance the motivation for heritage protection.

Moreover, so long as the attention paid to particular activities is above a certain threshold, other variables do not meaningfully differentiate levels within a given group. Behavior change as an objective policy outcome Q^2 predictive relevance measures results from employing as a principal focus of underlying objective change behavior. Q^2 values 0.297 for change behavior and 0.116 for awareness of cultural preservation, indicating moderate predictive accuracy. Such structures justify the inclusion of behavior as a basic metric of policy assessment that measures changes in local norms, participation, and awareness over time.

Though Table 7 shows no observable differences across age and gender in intention and actual behavior (p=0.225 and 0.164), it stands out in that these demographic segments show no statistically significant differences. Some areas can be applied uniformly without division into segments across sub-demographic areas.

Such universal advertising specialized for specific audiences tends to pass with flying colors, free for acceptance, such as education programs, public events, and participatory model apps.

Lastly, a multi-stakeholder governance approach is essential. The collaborative roles of government, local communities, NGOs, tourism businesses, and cultural institutions must be clearly defined. Public-private-community partnerships should be encouraged to develop, fund, and implement cultural tourism initiatives. Each actor brings unique capacities: governments offer institutional backing, communities provide local knowledge and stewardship, and private actors contribute innovation and investment. Policy frameworks should enable coordination among these entities, reducing bureaucratic fragmentation and enhancing collective impact.

The statistical results support a strategic policy orientation centered on behavior-driven transformation. By integrating educational outreach, participatory governance, institutional facilitation, and benefit-sharing mechanisms, policymakers in Hanoi can amplify the role of sustainable tourism in preserving cultural heritage. Future policy designs must be data-informed, locally grounded, and systemically coordinated to ensure that cultural assets are not only protected but also celebrated and sustained through community engagement and sustainable tourism practices. This approach ensures that heritage becomes both a shared responsibility and a source of pride for all stakeholders involved in Hanoi's cultural landscape.

Declaration of competing interest

The author declares that they have no known financial or non-financial competing interests in any material discussed in this paper.

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